

XIX. *Contributions to the Life History of Lycaena euphemus*  
*Hb.* By T. A. CHAPMAN, M.D., F.R.S.

[Read November-5th, 1919.]

• PLATES XXIX-XXXVI.

MONSIEUR OBERTHÜR has continued to pursue the investigation of the Myrmecicole species of *Lycaena* with the ardour and enthusiasm which we all admire, but which in no way surprises us, since they are always forthcoming for any Lepidopterological research. In 1918 the observations on *L. alcon* were followed up, and in 1919, *L. euphemus* has taken the front place in the work in hand. In both species Mr. Powell has been most active and successful, especially this summer in the case of *L. euphemus*; by a combination of hard work, and a genius for understanding and following up the details of the life histories of Lepidoptera, we have a complete view of the economy of *L. euphemus*; though, of course, there is still room for further observations. Mr. Powell began the campaign by finding a newly emerged *L. euphemus* over an ants' nest, and on examining the upper portion of the nest found an empty pupa case. This case is obviously one of a *Lycaena*, and as *L. arion* and *L. alcon* are practically ruled out, it must be the case of *L. euphemus*. For all practical purposes, the proof is almost complete that it is that of the imago found. The ants' nest was that of *Myrmica ruginodis*. Thereafter, in face of various practical difficulties, he obtained eggs and larvae in four different stages. I have to thank M. Oberthür and Mr. Powell most heartily for sending me material by which I have been able to follow up the history of the larva during the period of its pre-ant existence, and further to place larvae in the nests of ants and observe their life therein. I will relate my own observations as though they were original, as simplifying the narrative; but almost everything I observed was at the same time or earlier noted by Mr. Powell. Mr. Powell made one observation, viz. that of the ants carrying in the larva of *L. euphemus* to the nest with the same ceremonial that obtains in the case of *L. arion*. My specimens failed to afford me this

pleasure, though I devoted some time to detecting it. Probably it occurs less easily in the case of ants in small artificial nests, and the ants and the larva of *L. euphemus* are certainly much more apathetic towards each other than is the case with either *L. arion* or *L. alcon*, and *L. euphemus* is decidedly more active than either of the others, and not improbably finds its own way into the ants' nest in many cases.

The egg of *L. euphemus* is laid on one of the bracts at the base of the flower in the flower-head of *Sanguisorba officinalis*; the side of the egg is towards the axis of the flower-head, and the vertical axis of the egg is often at right angles to that of the flower-head. Oviposition takes place whilst the flower-buds have still some growing to do, so that the butterfly can push between them into the flower-head to reach the bracts inside. Later, the flower-buds grow, and the egg, and after, the larva, is quite imprisoned until it prepares a way out, for finally leaving the plant.

The egg is almost of the usual *Lycaena* shape, much that of a cheese, but at first glance seems very different. This is due to the top, which in typical *Lycaenas* is nearly flat and has an elaborate network of adventitious white material, but is, here, without the white material and is raised in a slight arch. The sides have the usual white network, and the top has a network without the adventitious white material. It is 0.6 mm. wide and 0.35 mm. high.

The larva lives inside the solid flower-head in its 1st, 2nd and 3rd instars. In the 3rd instar it completes the eating out of a space, very usually by scooping out one side of the axis of the flower-head rather above the middle, but not unfrequently without invading the central stem and even at various angles to it. In doing this it cuts several flowers (or fruits) free from the stem, so that one at least is easily pushed out when the larva wants to escape. The larva, full-grown in its 3rd instar and pretty well 4.0 mm. long, fills this excavated space, and there undergoes its third moult. This takes place in an extraordinary manner, one to which I know no parallel, either in *Lycaenids*, or in any other *Lepidopteron* whose moultings I have observed. Opened at the right moment, the cavity contains the larva of a very curious pallid aspect, and it is seen that the larva has loosened itself from the skin to be cast, and that the tracheae can be seen through it, drawn out for about a third of the width of a segment,

and that the pallid appearance is due to air between the effete and the new skin.

When I first saw such a larva, I said this larva tried to moult, but failed and died before it had made much progress. Some twenty-four hours after—and I believe, usually, after a longer period, but the point could not be tested with the amount of material I had, whose destruction I feared to risk—the moult is completed, the larva creeps out, hardly disturbing the seedpod pushed aside to allow of its escape. It is now ready to leave the plant in order to meet with ants. On examining the head that is left, the cavity is seen to be lined with the cast skin, which can, with some care, be removed in the form of a complete skin fully distended; not quite complete, however, as the larva escaped from it by pushing off the head and a portion of the prothorax, which are apt to be lost in looking for the cavity containing the skin.

A good many *Lycaenidae* leave their first cast skins fully distended, and some even a later one, but the process of freeing itself from the skin, and to a slight degree beginning the moult and then resting for a day or two, as *L. euphemus* does, is a puzzling novelty.

Is it a rest in order to await suitable weather for adventuring on a new world? Is it foregone, if conditions are quite suitable when the process is begun? Possibly Mr. Powell may have some details throwing light on the meaning of this most unusual habit.

In the 2nd, 3rd and 4th instars the larva is of red or red-brown colour closely matching the colour of the flower-heads of the *Sanguisorba*. In the 2nd and 3rd instars the armature is of simple hairs with some lenticles. In the 4th stage the hairs are reduced to a series on each side of the dorsum and a lateral series below the spiracles, one or two to a segment; these hairs are 0.6 mm. long, below the lateral flange there are more numerous and shorter hairs. The hairs that were (comparatively) so numerous in the previous instars are replaced by stellate hair-bases set, one might say, as closely together as there is room for; some of these seem to be mere bases, some lenticles, but some carry short thick processes, about as long as they are wide and that are, of course, morphologically, hairs. This larva is, of course, no larger than it was in the 3rd instar; it is about 4.5 mm., though they vary a little in size; they do no eating till in the ants' nest. Seen from

above they have a curious square aspect, the eight middle segments form a parallelogram divided into eight segments, and the prothorax in front and the 7th to 10th abdominal segments behind, form two nearly semicircular ends of about equal dimensions.

Once established in the ants' nests they grow rapidly. In a week the 4.5 mm. larva becomes about 7 mm. long, and looks a little more when stretched; but a week or ten days later it is no larger, looks even smaller as though ceasing feeding with a view to hibernation.

I saw a larva eating an ant grub, which it did very rapidly; the larva maintained its stiff, straight attitude; it had the ant grub beneath the thorax, held it, and moved it forward with its true legs, and finished it by pressing it against the glass, through which I was observing it. The head was all the time retracted within the prothorax with the jaws pointing downwards; the hollow in the prothorax was large enough to give the head much freedom of movement, and when the meal was finished it might be said to lick its chops, as it passed its mouth rapidly with licking-like movements over the whole interior surface of the prothoracic hood, as though cleaning off any fluids from the eaten ant grub, and I could not resist the conclusion that that was what it was actually doing. This process of eating was very different from that of *L. alcon*.

I have never seen a larva actually amongst the ant brood, as was so usual with *L. alcon*, nor have I seen an ant take any notice whatever of a larva—they run over them and past them as if they were merely portions of the nests. The larvae are fairly active, may often be seen moving about, but are usually resting on the side of the nest a short way from the ant brood.

I have seen no ant milking a larva, except when I was watching for a larva to be carried into the nest; in this case the larva offered a fluid at the honey-gland, which was taken by a passing ant, who took no further notice. Further fluid was secreted and accepted by other ants three or four times in one case, but the ants made no further overtures.

On Sept. 17 a larva was taken from nest 3 and sent to be figured; it came back on the 21st and looked well; it was returned to the nest. The ants paid a little more attention to it than they usually do to the larvae of *L. euphemus*, which is, indeed, practically none at all. They

came up to it, rested a fraction of a second, tapped it with their antennae, a few waited a second or two, but all then passed on satisfied; their questioning may have been as to the arrival being a possible stranger and enemy, but equally looked like a welcome home and inquiry as to well-being. The next morning, 22nd, the four larvae are resting in the sides of the nest away from the brood as usual, and it is impossible to say which was the one returned.

A comparison of the larvae of *L. arion*, *L. alcon* and *L. euphemus* in their several instars up to the time of entering the ants' nests, brings into strong relief the extraordinary peculiarity of *L. alcon* in having only two moults and three larval instars. In the first instars they are very much alike. The most obvious differences are that in *L. euphemus* the spiracles are of very large size, nearly twice the diameter of the others. The lenticles are fewer. The prothoracic plate has, in *L. alcon*, the usual pair of lenticles large, and on the front margin; in *L. arion* they are small and a little way from the front, and in *L. euphemus* it is doubtful whether they can be said to be present.

In the 2nd instar, *L. alcon* has several pairs of lenticles on the prothoracic plate, the others fewer. *L. alcon* also has more lenticles than *L. euphemus*. *L. arion* has a stronger panoply on the general surface, more lenticles, and the "skin-points" are especially large and dark. The size of spiracles in *L. euphemus* is now little different from the others.

In the 3rd instar *L. euphemus* has the least elaborated armature, the skin-points are well developed, but there are very few lenticles, except on the last segments, and no stellate hair-bases; on the abdominal segments are about twenty black, not long, hairs, to be counted between the dorsal line and the spiracle. In *L. arion* there is an abundant armature, far short, of course, of that in the next instar, but with very numerous lenticles and hair-bases, not easily distinguished from each other, and here and there slightly stellate. In *L. alcon* the hairs are about as numerous as in *L. euphemus*, but are longer and there are a great many lenticles (and hair-bases?), but these carry no abortive hairs, and show no stellation. The armature is, in fact, less simple than in *L. euphemus*, hardly so full and developed as in *L. arion*, very definitely therefore a

3rd instar panoply. This is the last instar in *L.alcon*. The 4th instar is reached by *L.arion* and *L.euphemus*, and they are very much alike at this stage. They have a dense coat of stellate hair-bases; they have on the dorsum a long hair on each side and a long one below the spiracle. *L.euphemus* has a second smaller dorsal hair on 4th, 5th and 6th abdominal, and has the first abdominal segment narrowed and without dorsal hairs. The prothoracic plate in *L.euphemus* has much the form of a boy's kite—a rather broad one. In *L.arion* it is more rounded and shield-shaped. In both, on the margins of the segments the hair-bases carry minute hairs, most obvious on the fronts of the 3rd to the 6th abdominal. These are more usually hairlike in *L.arion*, in *L.euphemus* more frequently thick and clubbed.

In the remarkable solitary instance in which I obtained a 4th instar specimen of *L.alcon*, the hairs and lenticles are much as in the 3rd instar; the lenticles (or hair-bases?) are circular, none stellate, but there are certain minute clubbed hairs very like those in the fourth stage of *L.euphemus* and *L.arion*, and of which there is no trace in the third stage of *L.alcon*. There is a double row of these in the incision between the metathorax and the first abdominal segment, numbering about forty altogether, perhaps a single row along the border of each segment, a few others may be found on the mesothorax and on the 6th and 7th abdominal segments. The bases of these are smaller than the lenticles, receding from, rather than approaching, the stellate form. There may be other points that escape me, the specimen being a little immature, but these hairs fully indicate that the larva of *L.alcon* retains a memory, weak and indistinct, of a 4th instar, probably with an armature not unlike that of *L.arion* and *L.euphemus*.

It may be noted that the enlarged meso- and metathoracic segments dorsally in *L.euphemus*, together with the smaller and weaker 1st abdominal, present a resemblance to the curious attitude we saw in *L.arion*, and which Mr. Powell has seen in *L.euphemus*, which the larva assumes when being carried in by the ants. There is no corresponding weak 1st abdominal in *L.arion*, but in *L.alcon* this segment is faintly narrower than the following segment and has only about half the number of hairs, about ten instead of twenty, across the dorsum between the spiracles. The

primary hairs that are so strong in *L. euphemus* compared with the other species, obviously might interfere with the ant getting a proper hold of the larva by the 1st abdominal segment, which seems to be the correct position at which to grasp it, were they equally strong here as elsewhere. The disappearance of the dorsal hair gets over this difficulty.

The long hairs in *L. euphemus* would be inconvenient if the larva lived amongst the brood, as that of *L. alcon* does; but it always rests on the wall of the nest, its own length and often much more away from the brood; these two facts are no doubt therefore correlated, but precisely how this is brought about is less evident.

There is ground for much speculation, but, so far as my present knowledge goes, for little else, as to how English *Myrmica* of two (and possibly all) species can satisfactorily entertain the larvae of *L. alcon* and of *L. euphemus*.

There is sufficient room for astonishment that these *Myrmica* (*M. scabrinodis* and *M. laevinodis*), natives of Reigate, are excellent hosts for *L. arion*, which their ancestors can only have known a considerable number of generations back, and any crossing with species of *Myrmica* familiar with *L. arion* must have been exceptional and very indirect. Still, one may explain in that way that *L. arion* is not altogether strange to them. But when we come to *L. alcon* and *L. euphemus*, we are dealing with species that Reigate ants cannot have known during some uncounted generations. It is to be observed that we cannot say they know all about *L. arion* and the same instinct serves them with these other species. The habits of the three species of *Lycaena* in the ants' nests differ distinctly in each species, and their treatment by their hosts equally differ in each case. The attitudes of *M. scabrinodis* and of *M. laevinodis* are identical with each *Lycaena*. Each treats *L. arion* with a certain amount of care, but has an extreme solicitude in the case of *L. alcon*, whilst as to *L. euphemus*, they may be said, comparatively, to pay no attention to them.

One definite conclusion seems forced upon us, and that is, that the relations between *Myrmica* and *Lycaena* originated with the ancestors of the two genera, when possibly each was represented by a single species; that as *Myrmica* developed into a number of species, *Lycaena* maintained relations with all (? or most) of them; that as *Lycaena* subdivided into separate species, each form

trained all the species of *Myrmica* involved, in its special habits, and that all this took place at so distant a date, and through so long a period, that the necessary instincts are deeply and firmly impressed on the several species of *Myrmica*, so that they remain ready to act on demand, though they may not have been exercised for what in human chronology we might call ages.

I may give a rather fuller description of the egg and 1st instar, but a very detailed description of the three following instars seems unnecessary in view of the figures by Mr. Knight (Pl. XXX) and the photographs of the mounted skins (Pl. XXXI-XXXV), especially as I have mentioned various points concerning them in other connections.

I add also my notes from day to day to illustrate various items in the habits of the larvae. A possible redundancy here and there may be useful, as giving the facts from a slightly different point of view.

July 31.—The egg regarded as of the usual cheese shape of Lycaenid eggs has the top raised as a slight dome, and the bottom is also raised, *i. e.* not quite flat. The egg is green above and below and the side stands out as a white zone, the sides having some of the white material usual on Lycaenid eggs, the top and bottom being without it. The sides are nearly vertical, perhaps slightly narrower above than below. The egg is 0.6 mm. wide, 0.35 high. The lateral zone is 0.23 wide (or high), the difference between 0.23 and 0.35, *viz.* 0.12, marks the fullness of the upper and lower portions, say 0.08 for the top, 0.04 for the bottom. The cells of the white sculpturing of the sides are shallow, square rather than hexagonal, but of various forms, and about 0.02 in diameter. The top also has a network, tending to be more hexagonal, without any adventitious white material, and towards the margin at least with cells larger than those of the sides, the transition being at a very marked and definite line, as is the lower margin of the lateral zone also. The actual measurement shows these cells to be very slightly larger than those of the zone, but the want of the white coat makes them look larger comparatively.

When hatched the larva is about 1 mm. long, of a light greyish tint, due to its interior structures, the skin seeming to be transparent and colourless. I have not seen it when grown, but suppose it acquires something of the ruddy



colour of the later instars. The head is dark, 0.23 mm. across, the jaws brown, with five sharp teeth and a short one on the lower margin. Ocelli, five in a curve and one rather larger at centre of curve. The prothoracic plate is pointed at each side, and produced to a blunt angle posteriorly, but only somewhat curved in front; it is about 0.18 mm. across; it has no lenticles, a pair of short hairs near the front and a slightly longer pair further back and wider apart.

There are several hairs in front of the plate and a pair behind it, and three or four in front of the spiracle and a little group of five almost in a vertical row behind it. On the mesothorax dorsally are, on each side, an anterior and two posterior hairs, the latter close together, the outer the shorter. On the metathorax there are a longer inner and shorter outer hair on each side of the dorsum, a minute hair behind these at posterior margin, and a lateral hair ranging with abdominal supra-spiracular hairs. On the abdominal segments there is a long dorsal hair (about 0.07 mm. long), a shorter one a little outside this, and a minute one at posterior margin. Above the spiracle is a hair about 0.03 mm. long, and a shorter one behind and a little above it. The 9th abdominal segment has no dorsal hairs but an anal plate; the 10th has about ten marginal hairs.

Below the spiracles are the usual three hairs (four in 2nd and 3rd thoracic). There is a lenticle below the first spiracle; there is also one just below the dorsal hairs on the 3rd (sometimes 2nd) to 8th abdominal segments. The spiracles are exceedingly large and the first is at the top of a chitinous tube deeper than the width of the spiracle; the spiracle seems to be level with the cutaneous surface, and not, as the tube suggests at first glance, at the top of an exterior column, *i. e.* the tube is the first portion of the trachea. The true legs are tinted, but much paler than the head. The prolegs have each an anterior and posterior set of hooks, each set consists of a larger and a smaller hook, of which the smaller is sometimes wanting. The claspers in one specimen had one hook in each set on one side, on the other side one set had one, the other two hooks.

In the 2nd instar the larva is about 3 mm. long and has acquired the red (or red-brown) colour, but it is hardly as dark as in the two following instars. The primary setae (dorsal and lateral) that exist in the first and in the last

instars, are not here obvious by differentiation from the other hairs. It is, of course, only an assumption, quite reasonable, but also quite open to doubt, that the long hairs of the last stage are primary setae. The hairs over the dorsum (spiracle to spiracle) of an abdominal segment are fourteen to sixteen, but vary in number and disposition from segment to segment, and vary in length from about 0.2 to 0.3 mm.; some on the prothorax are a little longer. The skin-points are conspicuous and somewhat regularly arranged. The head, legs, and prothoracic plate are dark (black till magnified). The lenticles show something of the same irregularity of disposition as the hairs. The prothoracic plate has two pairs, and also a minute pair that seem to represent the special angular hair. In the specimen noted, there are two lenticles in front of the right half of the prothoracic plate, and one near the left angle; there are none on 2nd and 3rd thoracics. The 1st abdominal has a lenticle above spiracle on left side only, none on right, all the other abdominal spiracles have such a lenticle above them, and 4th and 5th abdominal on right side only have a second, just above and in front of the first. The 5th and following segments have a lenticle on each side of dorsum near front margin. On the 7th the spiracular lenticle is a good way above the spiracle; on the 8th it is close to the spiracle and in front of it, and on the right side only another rather behind though above; the two dorsal ones are rather close together and just in front of four rather long hairs placed trapezoidally as does not occur on any other segment. The 9th has the two dorsal lenticles only; the 10th has them also and a pair behind them perhaps representing the anal plate, that is otherwise absent.

The honey-gland is represented by a smooth oval area, about 0.2 mm. from angle to angle, with the skin-points arranged in condensed lines closer together and smaller in size as they approach the smooth area. Very remarkably the centre of this area carries a small hair about 0.1 mm. long.

The spiracles do not differ materially in size from those of *L. alcon* at the same stage. In *L. alcon* the spiracles are each on a low chitinous cone, and its lenticles have a similar appearance; it has no trace of honey-gland, and lenticles are very numerous on the prothoracic plate. On the prolegs in this instar there are to each set (anterior and posterior of each proleg) one long hook and two, and occasionally three, short ones; on their bases are only two or three quite

small hairs. In the 3rd instar each set has two large and three small hooks, but with a little variation. The claspers have three hooks; one or two may be large.

In the last instar there is considerable variation in the hooks of the prolegs—a usual formula is two long, two medium, and five short; there may be four long, and it may be difficult as to several hooks to say whether they are long or short; eleven seems a usual total number. The column of the proleg has a covering of very short hairs with conical bases. The marginal group above this has twelve to fifteen similar short hairs, as well as stellate lenticles or bases.

The 4th stage larva has the first six abdominal segments with a dorsal surface, raised a little at each side, but with a deep recess in the middle line at its anterior margin. This recess has stellate hair-bases at the bottom of the hollow, but the sides are nearly free from them. In the 3rd instar there is no trace of this, but at the posterior margin of the segment there is a small shining point as of a chitinous plate; this is almost hidden in the incision; the mounted skin, however, shows no such structure.

In 4th stage the hollows in the dorsal line on the 2nd and 3rd thoracic segments are in the middle of the segment and not at the anterior margin as on the abdominal. On these the saddle behind the depression is lower than on each side, giving a dorsal depressed line, sinking much lower at the depressions and incisions.

The following are some of the detailed notes made from day to day.

July 16.—Mr. Powell found a ♂ *L. euphemus* drying its wings and, searching below, found a pupa case just over a nest of *Myrmica ruginodis*. The pupa case (sent to me) is obviously that of a *Lycaena*.

July 30.—Received from Mr. Powell six heads of *Sanguisorba* with eggs of *L. euphemus*. The egg is inserted almost close to the central stem, between the bracteoles and pedicels; the flower-buds would appear to have grown larger since the laying, and are packed together so tightly that it seems impossible that the egg could have been placed beneath them and got into place except when they were smaller. The egg appears to be lightly attached to the base of the bracteole by both surfaces, or by one to the pedicel. The side of the egg is towards the main stem.

Aug. 22.—Received from Mr. Powell five larvae of

*L. euphemus*, said to be in five heads of *Sanguisorba*; when they arrived all the larvae were on the paper containing the heads, the latter fairly fresh (had been posted 20th). The largest of the larvae was lethargic, seemed dead, but had a firm tone that suggested it was stunned by travelling or more likely sickening for moult. The larvae were reported by Mr. Powell to be in 3rd instar, and that they underwent another moult. The other four larvae were replaced on heads of *Sanguisorba* and were, so far as appeared, all right.

Aug. 23.—The largest larva (about 4 mm.) had clearly been laid up for moult, as this morning the old skin had been moved a little, some air under it and tracheas slightly withdrawn, the larva still immovable, slightly curved. Two of the other larvae were still wandering and two invisible, supposed buried in heads. One of the wandering larvae was offered heads of *Poterium*, this was not accepted.

Aug. 24.—This morning the large larva, which had made no move last evening, had cast its skin, which remained fully distended; the larva itself had spun a few threads to form a resting-place. Shortly after it was found on the move with a fluid globule on the honey-gland. It was placed in nest of *M. scabrinodis*; the ants paid little attention to it. It was moved to a small collection of ants and brood, but a quarter of an hour later the ants had removed the brood and left the larva stranded alone. Later they frequently examined it, apparently sometimes biting it, but without injury. It secreted various supplies of honey, which was lapped up by passing ants, but never sought for and not found by the ants actually examining it.

Aug. 25.—This larva was found dead, a little shrunk, amongst débris; it had been bitten as evidenced by marks, but the skin did not appear to have been pierced.

Of the four smaller larvae, two were dead, one was crawling on the glass, and one was half buried in a head of *Sanguisorba* with some frass behind it. The wandering one was offered the best remaining *Sanguisorba* and heads of *Poterium*. Later its head was buried in the *Poterium*; but there was no definite indication that it was eating.

The larvae are dark red, almost identical with the colour of the *Sanguisorba* heads when just past flowering. The smaller ones are about 3 to 3.5 mm. long; the larger were about 4 mm., but would probably have been a little more stretched. When it had moulted, the dorsal hairs were

seated each on a rounded boss, occupying nearly the width of the segment beside the middle line; the lateral hairs were like the dorsal, long and conspicuous. The hair-bases are very closely packed together.

Aug. 28.—Third and fourth stage larvae.

The 3rd stage larva (hardly full grown) is nearly or quite 4 mm. long when stretched, and 0·7 mm. wide; the 4th stage 4·5 to 5 mm. long and 1·5 mm. wide.

The 3rd stage tapers a little backwards; the 4th stage remarkably square, the two sides being parallel, only the ends rounded.

The most notable difference between the two is in the hairs in 3rd stage being distinctly hairs and sparsely distributed, and in 4th being largely hair-bases closely packed. Both are of a deep dark pink-red, almost the same as the colour of the head of *Sanguisorba* when flowering is over, but before it begins to get very dark. In the 3rd stage the incisions are well marked, but the margins on dorsal view show each segment rounded and projecting and not so distinctly a rather separate square projection as in the 4th. The head and legs are dark, but not quite black; the prothoracic plate is also very dark.

In the 4th instar the square outline when the larva is at rest is notable; when actively moving there is a little tapering towards the tail; but when at rest the prothorax in front and the 7th, 8th, 9th and 10th segments behind form semicircles, which are almost identical in size and outline; the eight intermediate segments are also all very similar, the mesothorax and the 4th, 5th and 6th abl. being a little wider than the others, the 1st abdominal smaller.

On Aug. 28 various larvae are noted as looking well in ants' nests (*Myrmica scabrinodis* and *M. laevinodis*), but nest 1 was without a larva, and a new larva was placed in it.

On Aug. 30 this larva was found dead. Another larva was given and was finally accepted. Larvae in other nests well, all near the brood, but not in it.

Sept. 2.—Yesterday I hunted for *Myrmica* to obtain some brood to supplement some of my nests; I obtained, however, only a small quantity of brood, which I left in a tube, putting in with them three larvae of *L. euphemus*. At about 1·45 p.m. (G.M.T.), having previously frequently looked at the tube without result, I found one of the *L. euphemus* larvae eating an ant grub. The latter was already about three-parts eaten, so that what size it was is

doubtful, but the width of segments on the portion remaining suggested a half-grown one. The *L. euphemus* was on the side of the tube, so that its under surface was easily examined. It was straight, in its usual resting attitude, and the remaining portion of ant grub stretched from the front of the *L. euphemus* to the end of its thorax; it had a pulsating movement, showing that the jaws of the *Lycaena* were at work. Almost at once it was seen that the legs of the *Lycaena* were appearing round the edge of the ant grub remains, and very soon they had it between them and were actively manipulating it to bring it more directly to the head of the larva. In a few minutes the ant grub was so reduced that the head of the larva could be seen, with the jaws actively at work; the whole observation did not last more than a few minutes, and it may be understood that the eating was rapidly done.

The next immediate stage was that only a bit of skin of the ant remained, and this was then eaten, almost rather swallowed than eaten, as it seemed to be drawn in bit by bit, without the bits being separated. During this last stage, the portion of ant grub was too small to be touched by the legs, and lay as it were in the hollow beneath the prothorax, possibly held there against the side of the tube. So soon as it had disappeared, it was evident that the head of the *L. euphemus* was retracted within the hood of the prothorax, so that the margin of the cavity formed by the hood seemed to be against the glass and the head freely moved within. It continued a sort of eating movement, but quickly changed to moving round, almost rapidly, licking the inside of the hood, which may well have been moistened by the fluids of the half-eaten grub which must have touched it; this continued till the surface all round had been gone over several times and the first pair of legs were also licked. Though the larva has no tongue, I say licked, as the movements had all the aspect, and I should say for practical purposes, all the effects of licking. It then settled down in its ordinary resting position, and was in the same place and attitude half an hour later.

Sept. 6.—Four larvae in nest 3 (*M. laevinodis*) are 6 to 7 mm. long, they rest on the side of the nest, all four head downwards. The small bosses on each side of the dorsum are marked, and especially on the 2nd and 3rd thoracic they are very large, a fact that is accentuated by the lowness and narrowness of the 1st abdominal. The prothorax

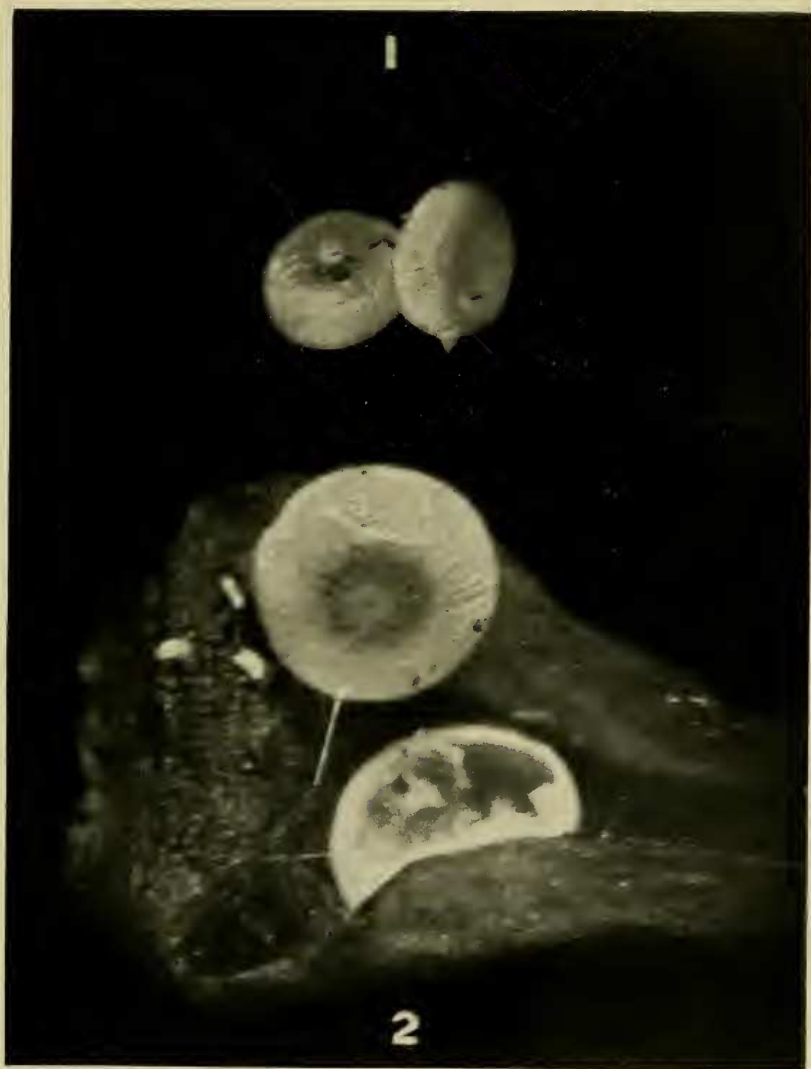
has a depressed central dorsal area, with the prothoracic plate in the middle. The margin round this area is swollen into a roll continuing round the whole front of the larva; one connects this structure with the method of eating the ant grubs already described, when this thickened roll falls down to form the "hood" mentioned. When advanced a little so that other parts of the prothorax are not just behind it, it is seen to be devoid of the ruddy colour of the rest of the larva.

Sept. 16.—Nest 5 contains eight larvae, some 6·0 or 7·0 mm. long; they don't seem to have grown appreciably during the last ten days. The same remark applies to the larvae in nest 2, one in nest 1 and four in nest 3. Indeed, some of the larvae seem to be hardly as large or thick as some days ago, as though they might be ceasing feeding with a view to hibernation.

The ants themselves seem to be doing well, and eggs and young grubs are present; their present food is honey and earwigs. The amount of brood, however, seems hardly sufficient to feed the *L. euphemus* in the spring, if all goes well with them. Some brood is obtained and added to the nests, but unfortunately *Myrmica* nests are rare within reasonable distance, and those found are almost without brood. Possibly the dry season restricted their food supplies, so that all had to go to completing rearing of the ♂♂ and ♀♀ against swarming.

Oct. 8.—The larvae appear to be about the same size though apparently still eating, at least the ant brood seems less in the nests with little brood, where a slight loss makes a difference; but a remarkable circumstance has been noticed in the last week or ten days, and that is that the long hairs of the *L. euphemus* larvae are being lost. Several were noticed with the hairs very short, about one-fourth of their proper length; one at least still had the hairs long. Now one or two seems to have none of the long hairs left. One suspects that the ants bite them off, but of course they may be thus shed naturally, nothing has been noticed to decide between these possibilities.

Oct. 9.—Examined all the larvae of *L. euphemus* that were within reach of a lens, actually all of them, but some of them were so placed as to prevent their being fully seen. One larva only had about half the long hairs present, three seemed to have no long hairs at all, the remainder were in various intermediate conditions—several with two or three



*Half-Tone Eng. Co., Ltd.*

EGG-SHELLS OF *LYCAENA EUPHEMUS* HB.